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WOODHULL LECTURE

The Control of Evolution in Man

Past and future

WHEN DARWIN PUBLISHED his *Descent of Man* in 1871 he was concerned with showing that man had arrived at his present state by long-continuing hereditary changes or variations in the past. He said as little as he could about these hereditary variations. He merely maintained that people varied, that the variations were partly inherited, and that in nature one was often selected in preference to another.

In his uncertainty about the mechanism of heredity and the causes of variation Darwin thought it better to study what had happened in the past, with results that could be seen, rather than venture into discussing the future. This task he left to a younger man, to Francis Galton.

To-day we may consider the problem of the future of man in three stages: the Galtonian, the Mendelian and the present or genetic stage. The points of view gained at these three stages have long appeared to be in conflict. Let us follow their sequence.

Galton's contribution

Galton began with a point of view on human evolution formed by his medical training, his African travels and his study of Darwin's work.[1,2] On the basis of the cell theory he took a view contrasted with Darwin's, first, on the inheritance of acquired characters, and secondly, on the distinction between one-egg and two-egg twins.[3] The use of this distinction led him to estimate the part played by heredity and environment, by nature and nurture, in the behaviour of individuals and races of men.

Galton noticed that like mates with like in man and thereby creates self-sustaining breeding groups. Accordingly he pointed out the significance of a higher frequency of colour-blindness in a particular group, the Quakers, and in doing so he revealed the foundations of population genetics. He also studied the genetic component of fertility and intelligence and applied this principle to the study of natural and sexual selection in different social classes. His method has been effectively developed to show that the decline of governing classes is hastened by their choice of wives of infertile heiresses.[4,5] Similarly he inferred that the expulsion of the Huguenots from France and of the Jews from Spain was an enduring loss to those countries and an enduring gain to other countries. In these arguments Galton was assuming that men make manners or culture before manners or culture can be said to make men. Finally he concluded that "the human race has a large control over its future forms of activity . . . for it can gradually modify its own nature".

Galton thus foreshadowed a genetic interpretation of the structure and also of the history of society. It is an interpretation whose validity has often been questioned but those who question it always neglect to refer to the words of Galton himself.

To-day a number of practical and theoretical advances may be traced to some aspect of Galton's work. One such advance is the use of intelligence tests for the measurement of educability especially in children.[6] These tests have indicated that the less intelligent individuals, groups, and populations of men can now easily propagate their like faster than the more intelligent.[7,8] This has not happened before in history or, we may say, in evolution. Survival which formerly depended on the abilities of individual

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parents now depends on the policies of nations. The present world crisis in population is thus likely to be not only a quantitative but a qualitative one. And it is likely to have consequences for our evolution.[9]

A second advance we owe to Galton, both in theory and technique, is in the demonstration in Holland, the U.S.A., and recently in Tasmania and in England[10,11] that migration modifies the intelligence of a community. The most active farmers move on to the best land. They exercise discrimination. They select their environment. This is why in all countries, including our own, the standards of farming vary from district to district. Similarly the migration from country to town and from town to town, and, as Galton pointed out, from the provinces to the metropolis, is reflected in the activities of the parents, and also in the educability of the children. It should affect, but is not always allowed to affect, the proportions of them who are thought worth training in universities.

Later events have provided tests of Galton's views on the effects of selective migration. For example, when a metropolis is cut off from a nation which has helped to create it by selective migration, we have often seen the "balkanization" that follows. With the present direction of cultural development it is the rural rather than the urban side which decays.

But perhaps the best test is through fertility. On the one hand by selection for fertility together with inbreeding the Hutterite community have recently raised their average from 9·2 to 10·9 children per family.[12] On the other hand consider Ireland. In 1847 the population reached over 8 million with a density equal to that of England and Wales. It had multiplied six-fold in under 140 years. Following a loss by emigration in ten years of 1½ million the population of Ireland has been almost stable for fifty years at half its peak number. Selective migration has modified the character of the people in many respects. High fertility, it has been argued, would have been differential in its effects. It might have selectively lowered the fertility of the people who remained and thus have led to the uniquely low and stable birth rate in Ireland to-day. When we have learnt more of the genetics of fertility we shall be able to return to this question.

Classical genetics

To a student of genetics to-day Galton's theories seem to be well founded and well considered. But at the time they were bound to appear as resting on a basis of a mysterious or incalculable heredity. In these circumstances the rediscovery of Mendel in 1900 might have been expected to strengthen the position of Galtonian as well as of Darwinian theory. It did not do so.

For Bateson, to be sure, Mendelism at once seemed to clarify certain primary issues.[13] For the first time it showed that hereditary variation was largely invisible. A man might suffer from a defect such as too little pigment in the skin or too much pigment in the urine through heredity, although no known ancestor had suffered from it.[14] For the first time heredity could be seen as responsible not only for the likeness of brothers

TABLE 1

Number of Children Ever Born to Married Ethnic Hutterite Women 45 Years of Age and Over, 1950

Age Group	NUMBER OF CHILDREN																	Total	Median
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
45-49	2	0	3	2	2	2	7	10	4	11	10	9	13	6	7	6	0	94	10·9
50-54	1	1	1	2	2	5	3	8	9	5	4	11	9	3	2	3	3	72	10·3
55-59	4	1	2	2	3	4	6	3	4	9	6	12	4	1	3	0	1	65	9·9
60-64	2	0	1	0	1	2	1	1	6	6	8	3	1	2	2	2	0	38	10·3
65-69	0	0	1	3	0	0	1	0	7	7	2	2	1	2	1	3	0	30	9·9
70-74	1	2	1	0	1	0	1	1	1	3	9	4	1	2	1	1	0	29	9·2
75-79	0	0	0	0	1	1	0	3	0	0	1	1	0	0	1	0	0	7	....
80-85	0	0	0	1	0	0	1	0	0	1	0	0	0	0	1	0	0	5	....
Total	10	4	9	10	10	14	20	25	31	42	40	42	29	16	18	15	4	340	10·4

(from Eaton & Mayer, 1954).

but even more significantly for their unlikeness. Or, to put the matter the other way round, variation was largely concealed by heredity but occasionally revealed, and revealed by known processes. In disclosing these primary paradoxes suddenly Mendelism had magnified the genetic at the expense of the environmental component in all variation. Not only the cards but also the process of shuffling was a manifestation of heredity, and a calculable manifestation.

Owing to the hot disputes between Bateson and the followers of Galton, however, the unexperimental aspects of the new advance were pushed into the background. Since the Mendelian design of experiment required gene mutations of gross effect they were taken by Bateson and later by Morgan as the units of natural variation. Moreover the pure lines of Mendelian experiment were taken as the raw materials of natural variation. The model systems that resulted were easy to handle in theory but they gave an unconvincing account of natural variation in any organism, above all in man where so much variation failed to fit into a Mendelian scheme.

It was in this period that environmentalist explanations of human variation gained ground in the social sciences. Mendelism, unhappily using the word "character" instead of "variable" was too crude and naïve to explain the subtleties of human variation: they came to be left to the operation of spontaneous causes subsumed under the word culture. And it has been argued by a strange perversity that because culture can sometimes be socially *transmitted* it can never be racially or individually or genetically *created*.[15]

Mendelism has now, however, grown into genetics. The changes that it has undergone have given us a new idea of human society and human evolution.

Genetic systems

Genetics has grown, in the last thirty years, by spreading down into the cell, up into the population and out into the open air. This growth has developed the paradoxes as well as the laws of heredity. In the breeding experiment we see the reaction of a definitive heredity with a definitive environment. In the fixed natural population we see what is there after the environment has selected the heredity. In the mobile population we see what is there after heredity has also, in its turn, selected the environment. The opposed agents are not independent: they interact in sequence. And sequence usually begins with a variable heredity.

In the laboratory breeding experiment each individual which arises by the uncertainty of recombination is important. In nature the whole population which is almost exactly predictable is what matters. This contradiction leads to a shift of emphasis which affects our description of variation in any organism. Again, to the experimental breeder the unit of variation is the gene mutation. To the cytologist it may be an inversion or an interchange of a piece of chromosome. And to the naturalist it may appear as a polymorphism, a floating "variety".[16]

The bringing together of these three methods of inquiry has now established that the bulk of natural variation is due to the mutually adaptive combining of mutations and structural changes; that the mutations themselves are of different orders of size; that in most of their activities they are the individually undetectable parts of multiple or polygenic systems; that genes expand or contract according to the size of the breeding group within which they are being exchanged. Not only this but polygenic systems are adapted to the range of variation of the breeding group within which they subsist. Their evolution is therefore itself subject to changes in the size and character of the breeding group. Genes and genotypes are therefore related to breeding groups and breeding systems and have to be considered together with them in examining the evolution of any species.[17,18]

This transformation may be illustrated in the most successful field of human genetics. For fifty years the study of blood group antigens has proceeded on Mendelian lines. In this form it has led to the most detailed account of geographical variation known in any organism.[19] Gradually, however, the structural complexity of some of the genes or super-genes concerned has been predicted by Fisher, and demonstrated by Race.[20] Independently their physiological complexity has been predicted by Ford[21] on the analogy of the polymorphisms of other animals. And this complexity has now been demonstrated with remarkable selective and evolutionary

implications by statistical studies of their relations with susceptibility to disease.[22]

Lately the hæmoglobin genes have gone further in showing how malarial diseases have forced whole races of men to modify the composition of their hæmoglobin as a means of avoiding extinction. In doing so they have introduced an adaptive polymorphism more drastic than that known in any other animal,[23,24] comparable indeed only with that of hybrid species of plants.

These relations, paradoxical or dialectical as they may be, mean that we have to begin our study of heredity in any organism much farther back than we had thought necessary. In studying the evolution of man we first have to examine the history of his breeding groups. Fortunately, however, the breeding groups are better understood than those of any other organism. Let us see how they work.

Human breeding systems

For some thousands of generations until recently, man has been a sparsely distributed species gradually spreading over the earth as, by his own evolution, larger areas became profitably occupiable or habitable by him. He still exists in simple societies whose breeding habits, since they are found in all continents, are assumed to correspond with those of his common ancestors. Mating is limited not by his immediate fertility but by self-imposed rules of exogamy and endogamy, that is by a rejection or prohibition at once of close inbreeding and of wide outbreeding.[25]

The repugnance for outbreeding is of course a common property of all animals. But it has become a more variable and also a more discriminating repugnance in man. The repugnance for inbreeding on the other hand is new. It has demanded something more than discrimination. It must have arisen either from the experience (which is universally true) that unusual inbreeding yields an unusual proportion of defective recessive types in the offspring; or from the selection of races in which an instinctive reaction took the place of such an intelligent inference.

The combination of exogamy and endogamy must have always had, as it has to-day, a precise effect on the mating groups in which man exists. The effect is comparable only with what arises from the incompatibility of plant systems.[26] It means that within these groups three special properties will be favoured: maximum hybridity, maximum recombination and maximum uniformity. We expect, and the evidence seems to confirm our expectations, that wherever the groups are small and stable these properties will soon be established.

All of these properties are, it would seem, selectively valuable for the immediate welfare of the group. They have, however, one important consequence for the future of the group: it is to discourage any spontaneous genetic cleavage within it so long as its members live within range of one another. The group is homogeneous and its homogeneity is preserved by the rules of exogamy. Differentiation in social function, in occupation, will arise between the sexes and between young and old but it will not arise spontaneously between genetic sections within the mating group. It has even been suggested that pairs of such primitive societies in Australia may fuse and combine their marriage and incest rules to allow of a new uniformity in the enlarged breeding groups.[27]

In advanced societies we have close parallels with the endogamy and exogamy rules of primitive societies. Neither, to be sure, is so rigorously maintained. And the breeding groups established can be shown—since we can follow their history over thousands of years—to be of varying stability. But their fundamental contrast with those of primitive societies consists in their differentiation. They are horizontally differentiated or stratified in groups or classes which meet but do not mingle. These classes, which come to work and think and speak[28] differently, cooperate by virtue of genetic differences which they preserve by not interbreeding.

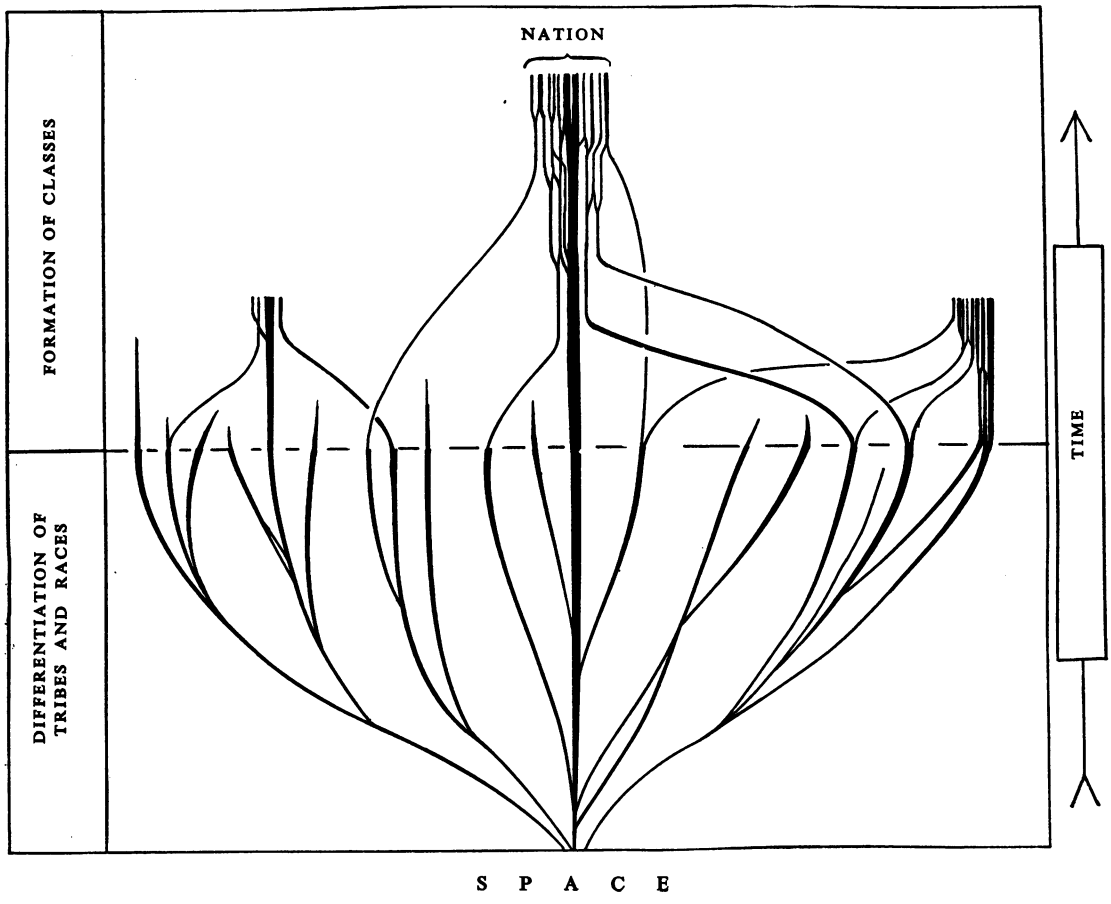
To the rule that social classes cannot be preserved if they freely inter-marry there is one legendary exception, the Natchez Indian tribe of the Mississippi valley. But the four classes described could not in fact have maintained themselves in numerical balance let alone in genetical stratification if they had followed the rules attributed to them.[29] There is indeed no exception to the rule: social differentiation and breeding differentiation are mutually indispensable.

The development of social classes, beginning at the neolithic stage, has evidently been concerned with the development of all civilization. But it has followed quite different lines in the main areas of civilization. The great religious systems of Hinduism, Judaism, Islam and Christianity have diverged in their effects on the breeding system. Most striking is the contrast between India and the Middle East. In India a unity of religion sanctions, and indeed prescribes, the diversity of "breed" or "caste". In the Middle East since the triumph of a tolerant Islam a multiplicity of religions is the chief guarantee for the permanence of a multiplicity of professional breeding groups. Underneath this contrast, however, the genetic principle is entirely uniform. It is also, we may notice, quite distinct from the automatic systems of genetic caste distinction which are known in the Hymenoptera.[30] Inter-fertile classes which work together without breeding together uniquely distinguish advanced human societies from all other forms of animal life. The system, it seems, has made advanced societies possible.

If the breeding systems of primitive societies always favour uniformity or homogeneity in their genetic structure how has differentiation or stratification come about in advanced societies?

One source of differentiation is to be found in the nomadic communities best known in Arabia and Somaliland. Tribes where sheikhly and slave castes are undeveloped, have become different in their genetic character. Their

DIAGRAM REPRESENTING THE AUTHOR'S THEORY OF THE DEVELOPMENT OF CLASS STRUCTURE
(Not included in the original Woodhull Lecture)



differences are shown first in their mental and emotional character, and by derivation in the kind of work they do and the skill they acquire in it. From this differentiation of tribes their co-operation and commerce arise by agreement.[31]

Such a peaceful co-operation of racially different people has evidently been one of the bases of class differentiation wherever craftsmen and sailors, merchants and missionaries have wandered and settled. But the foundations of class structure have been laid as much by conflict as by friendship. Governing classes owe their origins largely to conquest. Agriculture owes its development largely to slavery and slavery also largely arises from conquest or piracy. "Bondmen" shall be "heathen" and "strangers" (*Leviticus* XXV, 44-46).

The evidence of history and of prehistory, seen in the light of genetics, is unmistakable. Differentiation within nations has always arisen, so far as we can trace it, from a mixture of races. In Greece and Italy, in Britain and Russia, no less than in India and the Middle East the nuclei of class structure, the foci of discontinuity, have been established from the mingling, friendly or forcible, of different races.

On this view, introduced genetic differences, whether racial or tribal, have sown the seeds of social differentiation and the co-operation of dissimilar individuals out of which the richness of human cultural development has arisen. How have these seeds germinated? All stratified societies that have survived (and there are some to-day which may not survive) have permitted a limited inter-breeding between the stratified groups: slaves could be freed, freemen ennobled and the Brahmin's offspring might sink to a lower social level. Roman Emperors and Indian Kings have by legislation and by direct action controlled these processes with the evident intention of controlling evolutionary change. The development of class society has depended on the slow and controlled mixture of the materials brought together in this way, mixture subject to the processes of mating, promotion and migration, all of them socially selective, and selecting differently in different societies.

In India, after some mixture leading to the formation of new hybrid castes, the inter-breeding has often ceased and, owing to incidental religious developments, the new stratification has hardened. This unique circumstance enables us to see the genetic processes of a diversification of society fossilised at a stage not far removed from racial mixture. In other societies we see other instructive situations. For example, in Russia and America strictly racial classes can exist together with a theory of classlessness. And a dissolution of classes can exist side by side with a crystallization under a new form of a class structure which spontaneously and predictably reconstitutes itself.

In all these changes we know how valuable the mixture of groups must be in providing the recombination which releases variability. Conversely, how important a restriction of mixture must be, follows from the Mendelian principle that one act of crossing can undo the work of a hundred generations of faithful inbreeding. A steady release of variability, therefore, demands a restriction of crossing. If a small group like the Greek merchants of Chios,[32] or the Quakers in England, or the Hutterites in Alberta, were to preserve their character they had to inbreed. Thereby they reinforced the homogeneity of that character, their consciousness of it, and often their desire to preserve it.

On this genetic view our advanced societies are vastly more complicated than anything envisaged by Galton. They are not races in a simple, primitive or biological sense. They are nations divided into differential classes. Their differentiation may be appropriate or inappropriate to the needs of the time and in this we may see the genetic component in the rise and fall of empires. The differentiated classes may begin by differing on the surface; but they end by differing more under the surface like the cryptic species of plants and animals. Their ability to keep apart is seen as indispensable to the maintenance of civilization but their ability to mix is seen as no less indispensable to the evolution of civilization. For it is from this mixture that we have, on the one hand, the hybridity and hybrid vigour that we ourselves need and, on the other hand, the recombination, the release of variability that our posterity need if they are to do anything new or face a changed world.

How does this view affect our attitude to the future of mankind?

Control of our evolution

It is now clear that man throughout his history has been interfering with his evolution by most of his political acts and most of his social habits. What has been almost entirely unconscious is bound now to become conscious. As we study the consequences of our actions we shall correct them. And as we introduce new actions we shall already be aware of their consequences.

How much do we know? We know that changes in our breeding system has the effect of creating visible diversity of form. We know very little of its effect on the relatively invisible diversity which concerns intelligence and fertility, viability and resistance to disease.

In the large outbreeding groups found in advanced societies almost as much variability should be released by a change towards closer inbreeding as by a change towards wider crossing. I have, therefore, made a small study of the frequency, distribution and effects of cousin marriage in our own population. It suggests to me that human stocks can be readily adapted to inbreeding. The change from outbreeding to inbreeding leads, as in other organisms, to depression especially affecting the invisible variables. But it provides the means of rapid improvement, if we want improvement.

On the simpler Galtonian selective level the development of medical science has, as we have seen, upset the world's population both in quantity and in quality. And the qualitative changes are very diverse. They affect race as compared with race, class as compared with class, and individual as compared with individual. Medical treatment of every kind of genetic disability, except lack of intelligence, enables those who have been treated to survive and to reproduce when they would not otherwise do so. Often those who were saved as children return to the same hospital with their children to be saved.[33] In consequence each generation of a stable society will become more dependent on medical treatment for its ability to survive and reproduce.

This is a process by which our control is changing the direction of evolution. We have to weigh its advantages and its disadvantages. Meanwhile let us note a larger principle: every branch of government in its own field controls the evolution of the people it administers. The punishment of crime affects the reproduction of the criminal class. Education affects or even determines the mating group of those who pass through the system. Taxation and subsidies affect the relative numbers of children born in the different social classes and can be adjusted to vary the results over a wide range. All these policies affecting health, crime, education and economy are carried out in unconsciousness of their evolutionary effects.

The governments of Augusta and Claudius (according to Suetonius) seem to have been aware of what they were doing in these respects by regulating the genetic diffusion between classes. Modern authorities with their more drastic actions are unaware of consequences. They are unaware because, like Darwin, they are not quite certain about heredity; and also because the actions themselves are traditional and are directed, not to breeding, but to the present life of the individual and the present economy of the state. New processes, however, are now appearing which are directed to breeding. They are not traditional and they therefore at once attract attention. Three of these are worth considering: ionizing radiation, sterilization and artificial insemination.

The classical geneticist is much impressed by the consequences of ionizing radiation in inducing mutations. When induced in the ripe sperm of *Drosophila*, and followed by two generations of brother-sister mating, these mutations lead to dire results. On man, living and mating at large, however, we do not yet know what the lasting genetic effects of such radiation may be.[34] The effects would be more likely to be deleterious than beneficial if it were to be followed fifty years later by cousin marriage among the grandchildren of the affected individuals. So far as we can foresee, they would be like the effects of cousin marriage in an unaffected population; this is another reason for studying those effects now.

The inverse of this problem is shown us by the introduction of the practical measure of the sterilization of genetically, usually mentally,

defective individuals. This kind of evolutionary control has been used for sixty years in the United States and for thirty years in Scandinavia. Here is one way, a negative way, in which governments are now assisting in the propagation of intelligence.[35]

TABLE 2

GENETIC-HYGIENIC COUNSELLING GIVEN TO PHYSICIANS BY THE UNIVERSITY INSTITUTE FOR HUMAN GENETICS IN COPENHAGEN 1939-1956.

Year	Legal abort.	Legal steril.	Legal steril. + abort.	Genetic counsel-ling
1939	3	0	0	3
1940	25	1	0	4
1941	21	1	0	10
1942	101	8	0	26
1943	150	9	1	40
1944	158	25	15	50
1945	174	28	34	58
1946	293	36	37	50
1947	364	29	51	58
1948	432	37	48	75
1949	591	66	68	58
1950	702	37	87	55
1951	741	62	112	69
1952	969	63	110	79
1953	913	55	103	84
1954	983	71	133	80
1955	1,099	95	145	68
1956	870	92	196	92
Total	8,589	715	1,140	959

(from T. Kemp 1957).

A positive means of propagating intelligence is provided by artificial insemination.[36] When this technique was first introduced pedigree cattle breeders foresaw great dangers to their own interests, and their foresight has been vindicated. The new method has undermined the value of the old criteria in cattle breeding. Now man, as we have seen, has a self-maintaining breeding system of a uniquely complex kind. It cannot be reduced to the steady formulæ of a cattle breeding system. Artificial insemination from a donor (A.I.D.) is therefore likely to have more diverse, but ultimately no less valuable, consequences for man than for a domestic animal.

What are these consequences? A third party is introduced into the control of the breeding process. If he is aware of its genetic consequences he may, like the Russian landowner who bred his serfs for beauty,[37] be able to render a service to society. Moreover, since his activities are likely to be limited to the remedying of sterile marriages, we shall have time to judge their results before any danger arises from them. But there is one serious qualification: if his results are secret there will never be any possibility of assessing or correcting or improving them.

There is one respect in which assessment would be useful. In the past the rigidity of human breeding systems has been mitigated by illegitimacy. From William the Conqueror to Abraham Lincoln illegitimate class-crosses, such as rarely arise through marriage, have produced men out of the common run. In advanced societies illegitimacy is declining; but through artificial insemination a means of escape from the laws of legitimate, that is, assortative, mating might be maintained with advantage to the community. And the advantage might be of an evolutionary decisive degree. For with the evidence of genetics before us we do not need to be persuaded that single individuals can alter the course of history or of human evolution.

The future

The problem of man's control of his own evolution now no longer appears as it did to Galton.

Two methods of control are continually operating. The one is through the process of selection which slightly or gravely changes the character of the world's popualtion in every generation The other is through the processes of inbreeding or outbreeding by which variability is preserved or released for selection to act upon. The first is obvious and easily understood; the second is deeper and less easily understood. But we now know we are interfering with both. It is a question of how we ought to interfere so as to do good and not do harm.

Most of the effects, good and bad, of any genetic policy can be felt only after the lapse of a generation. Moreover, the human breeding system is unique in its class basis, its elaborate discrimination, and its repugnance for outbreeding. Oppressed by closer fears modern governments take less care for posterity than did their predecessors in antiquity. Governments which provide us with education have forgotten that only our parents can provide us with the ability

to profit by it. There is indeed much evidence of a genetic component in the survival of nations. The nation which takes most serious thought for its own genetical future is, therefore, most likely to have a future.

APPENDIX *

ONE EXAMPLE MAY be given of how A.I.D. might be used for obtaining information of value for the control of evolution in man. The crucial evidence of the effect of cousin marriage on the fertility of the progeny is obtainable from double marriages where a man has children by two wives, one a cousin and the other an unrelated woman. This is set forth in the table below.

In these cases, unless the family has already been inbred, the progeny of inbreeding have fewer children and fewer grandchildren than the progeny of outbreeding. With A.I.D. such tests could be made on a large scale as a matter of routine and with even more informative results. Provided only that records were kept and were available for scientific study.

Indeed we may say that information derived in this way from A.I.D. in one generation would be indispensable for those carrying out A.I.D. in the next generation.

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TABLE 3

(i) JOHANN SEBASTIAN BACH (1685-1750)
Maria Barbara Bach (1684-1720) 2nd Cousin.
Anna Magdalena Wilcken (1701-1760) Unrelated.

Marriage	Date	c.				g.c.				g.g.c.
		t.	s.	m.	w.i.	t.	s.	m.	w.i.	t.
2nd Cousin ..	1707	7	3	2	2	6	3	0	0	0
Unrelated ..	1721	13	6	3	2	6	4	4	3	10*

* 28 g.g.g.c., 52 g.g.g.g.c.

(cit. Geiringer 1954, *The Bach Family*, London: Allen & Unwin).

(ii) ANTHONY 3RD BARON HENLEY (1825-1898)
1846 Julia Peel, 1st cousin (1826-1862)
1870 Clara Jekyll, unrelated (1836-1922)

Marriage	Date	c.				g.c.				g.g.c.
		t.	s.	m.	w.i.	t.	s.	m.	w.i.	t.
Ist Cousin ..	1846	6	4	3	2	4	4	3	1	2
Unrelated ..	1870	3	2	2	2	9	8	8	7	23+

(cit. Darlington 1958, *Triangle*, Sandoz, Basel, in the press).

Abbreviations: c, children; g.c. grandchildren; t, total born; s, survived to maturity; m. married; w.i., with issue.

* Professor Darlington has sent us this amplification of the discussion of A.I.D. towards the end of his lecture, with the accompanying table, and the diagram on p.173 which were not included in the Woodhull Lecture as originally printed.

EDITOR.

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